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(54) **Plug valve with fixed seating adjustment.**

(57) A lubricated tapered plug valve has a plug mounted for limited free axial movement away from its seat. The cover on the body at the large end of the plug has a stop surface for limiting movement of the plug away from the seat and spacers of preselected thickness are provided for fixing the axial distance the plug may travel away from metal-to-metal contact with the seat under the thrust of a spring which urges the plug away from its seat.

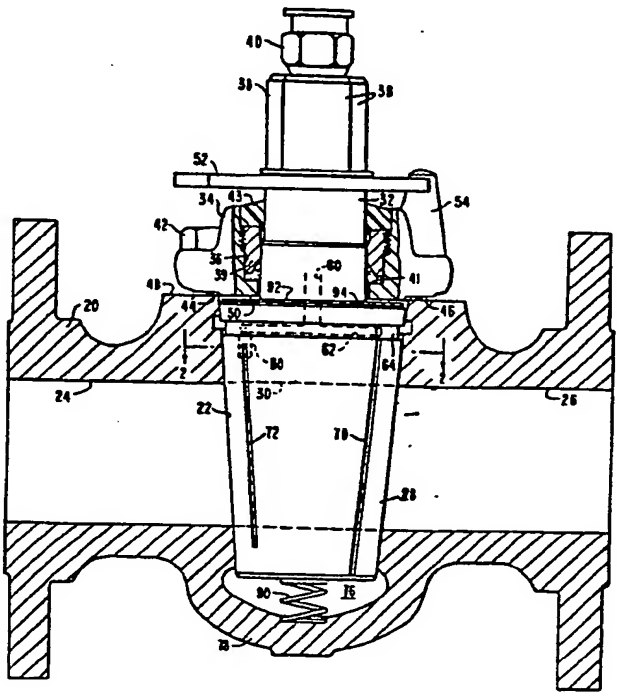

FIG. 1

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Background of the Invention

Field of the Invention. This invention relates to lubricated tapered plug valves and, in particular, those in which means are provided for preventing the plug from being "seized" or locked up as a result of transient operating conditions such as unusually high fluid pressure or temperature conditions of relatively short duration.

Description of the Prior Art. Conventional lubricated tapered plug valves, such as that shown, for example, in the U.S. patents to Nordstrom No. 1,781,821 and Staller et al No. 2,945,668 have a plug formed with a "locking" taper seated in a similarly tapered seat formed within the body. A system of lubricant grooves is formed in the tapered surface of the plug and in the seating surface on the body into which a sealant may be introduced in order to provide a sealing and lubricating film between the plug and its seat. Typically, as shown in those patents, the plug is biased toward the seat and even when a definite bias is not provided, in the type of valve shown in the former patent, the weight of the plug itself tends to urge the plug into the seat under the force of gravity, when the valve is mounted in an upright position as shown.

When such valves are placed in service in the field, they are frequently exposed to pressure and temperature transients of widely varying magnitude. Thus, while the valve may be installed in a line carrying fluid which is normally under 300 p.s.i., the line may be subjected to larger pressure pulses of relatively short duration which may be due to any number of causes, such as malfunction of a pump or a compressor. Also, when the valve is installed where it is exposed to the elements or near

other equipment which causes variations in ambient temperature, the valve may be subjected to widely varying temperature transients. These pressure or temperature transients or both, if sufficiently large in magnitude can cause the body to expand temporarily beyond its normal dimensions. In conventional valves such as that shown in the patents referred to above, the plug, due to its weight or due to the biasing force of the spring which is often provided, will be urged further into its seat than is normal as the body expands. When the pressure or temperature transients dissipate, the body will contract to its normal size and the plug will be seized or locked into the tapered seat making it difficult or impossible to rotate.

The U.S. patent to Eshghy, No. 4,034,776, shows a tapered lubricated plug valve in which the plug is fluid pressure balanced by means of passages in the plug which place chambers at either end of the plug into communication with the line fluid pressure in the port through the plug. Additionally, a spring urges the plug in a direction away from its seat against an adjustable stop member. In the assembly of that valve, the adjustable stop member is tightened down to a predetermined nominal amount to establish the proper relationship between the plug and its seat. Lubricant may then by injected into the lubricant system to provide a lubricant film of suitable dimension between the plug and its seat, the spring bias then being effective to maintain the desired space relationship between the plug and its seat. The problem that arises with such a valve and other prior art valves referred to above is that if the valve should leak when in service, the person responsible for the proper operation of the valve tends to assume it is because of improper seating thrust on the plug rather than a deterioration of the sealant film between the plug and its seat. Accordingly, the adjustable stop member is adjusted to place more seating thrust on the plug which simply tends to wedge the plug further into the tapered seat. Such a procedure may or

may nor temporarily cure the leak but it will also make the plug more vulnerable to lockup or seizure under the transient conditions that are described above and in the patent to Eshghy.

Applicant proposes to cure this problem by fixing the maximum amount the plug may move away from its seat at the time the valve is assembled by means internal to the valve which may, therefore, not be adjusted or changed after the valve is placed in servie in the field.

The U.S. patent to Staller et al, No. 2,945,668, shows a lubricated plug valve in which a shim or spacer is provided between the bottom cover and the body and a stop surface on the cover which defines the maximum amount the plug may move away from its seat. In that valve, however, a spring member is interposed between the stop surface on the cover and the plug to constantly urge the plug toward its seat. Thus, the plug in such a valve will be urged further and further into the tapered seat as the body expands under the pressure and temperature transients described above and will likewise be subject to seizure and lockup when these transients are dissipated.

Summary of the Invention

To meet the problems inherent in the prior art as outlined above, Applicant has provided a lubricated tapered plug valve in which by means of shims or spacers which locate a stop surface within the valve body the optimum spacing between the plug and the seat is fixed at the time the valve is assembled and, therefore, not accessible without disassembly of the valve. Also, a spring is provided which at all times urges the plug away from its seat against a stop surface to maintain the optimum spacing between the plug and its seat and, therefore, the optimum sealant film thickness. The stop surface limiting movement of the plug may be provided on the cover of the valve. In one form of the invention, the spacers are provided between the large end of the plug and the stop surface on the cover, while in another form of the invention, the spacers may be provided

between the cover and the body.

Brief Description of the Drawings

Figure 1 is a cross sectional elevational view of a plug valve embodying the instant invention.

Figure 2 is a horizontal sectional view of the valve taken along the line 2-2 of Figure 1.

Description of the Preferred Embodiment

Referring to the drawing, a body 20 has a central chamber which is defined by a tapered seat 22 formed within the body. Inlet/outlet passages 24 and 26 communicate with the central chamber in which is rotatably mounted a tapered plug 28 having a port 30 therethrough shown in dotted lines which communicates with the inlet/outlet passages when the plug is in its valve open position. A stem 32 projects from the plug 28 through an opening 36 formed in cover 34. The outer portion of the stem 32 has flat portions 38 for the reception of a wrench to facilitate rotating the stem and plug. A sealant/lubricant fitting 40 is mounted on the outer end of the stem and is adapted to receive a mating fitting on a grease gun for injecting sealant to the internal sealant system hereinafter described. A gland 39 is threaded into opening 36 and serves to compress a graphitic ring 41 into sealing contact with the outer circumference of the stem 32. A wiper ring 43 of elastomeric material is also provided in opening 36 above gland 39 to protect the gland and seal ring 41 from moisture and foreign particles. The cover 34 is secured to the body 20 by means of a plurality of bolts 42 only one of which is shown in Figure 1.

An annular metallic seal ring 44 is compressed between annular surface 46 on cover 34 and surface 48 machined on the top of the body 20. In one form of the invention, the seal 44 may also function as a spacer to achieve a proper spacing between the surface 50 of the cover and the top of the plug as will be hereinafter explained.

A stop collar 52 is secured to the stem intermediate its length and has circumferentially spaced stop surfaces

(not shown) which cooperate with a post 54 formed on the cover to limit rotation of the plug to 90 degrees.

An axially extending passage is formed within the stem 32, only a portion of which is shown in dotted lines at 60. At its upper end the passage 60 communicates with the interior of fitting 40 and at its lower end the passage 60 communicates with a radially extending passage 62 in the large end of the plug which opens into annular groove 64 formed in the outer surface of the plug 28 near its large end. Diametrically opposed grooves 70 (see Figure 2) are formed in the exterior surface of the plug and extend from the groove 64 to the bottom of the plug (Figure 1) where they communicate with a chamber 76 enclosed between a bottom wall portion 78 of the body 20 and the small end of the plug.

Diametrically opposed grooves 72 are also formed in the exterior surface of the plug but do not extend to either chamber 76 or the groove 64 as do grooves 70. Relatively short bridging grooves 80 are formed on the seating surface of the body at diametrically opposed positions as shown in Figure 2, one of which grooves is shown in dotted lines in Figure 1. Grooves 80 serve to connect the grooves 72 with annular groove 64 formed in the upper portion of the plug when the plug is in its closed position.

Lubricant/sealant is introduced into the system of grooves above described through fitting 40 and flows through passages 60, 62 into the annular groove 64. In either the open or closed position pressurized sealant/lubricant will flow into groove 70 and into chamber 76 whereby the plug may be jacked away from its seat 22, all as is conventional in the prior art. In Figure 2 the plug is shown in its valve open position where the grooves 70 in the plug surface register with bridging grooves 80 in the seat. However, since the grooves 70 extend the entire distance between groove 64 and chamber 76, the grooves 80 perform no function at this point. However, when the plug is rotated 90 degrees in a clockwise direction as shown in Figure 2 to its

closed position, the grooves 72 will register with grooves 80 in the seat whereby sealant/lubricant under pressure is supplied to grooves 72 through grooves 80 which bridge the end of grooves 72 and annular groove 64. Thus, when the valve is closed, one set of grooves 70 and 72 and the groove 64 all of which are filled with lubricant/sealant under pressure in the surface of the plug will circumscribe the opening to passageway 24 while the other set of grooves 70 and 72 and groove 64 will circumscribe the opening to passage 26 to form an effective seal to prevent the leakage of fluid between the plug and the seat. When the valve is rotated in a counter-clockwise direction from its closed position to its open position, the only grooves which are exposed to the passages 24 or 26 are grooves 72. However, upon initial counter-clockwise movement from the closed position, the grooves 72 will be disconnected from the bridging grooves 80 and, since grooves 72 do not extend to chamber 76, very little, if any, of the sealant in the grooves 72 will be extruded into the passages 24 or 26.

As mentioned above, in prior art valves, the plug is conventionally urged with varying degrees of resiliency toward the tapered seat in the body. In the instant invention, however, a spring 90 is compressed between the wall 78 of the body and the smaller end of the plug 28 so as to constantly urge the plug axially in a direction away from the seat. Additionally, at the large end of the plug means are provided whereby movement of the plug away from its seat under the influence of spring 90 is limited so that the space between the plug and its seat will at all times be that which provides an optimum thickness of lubricant/sealant film between the plug and its seat. In one form of the invention, one or more washerlike shims or spacers may be provided at the large end of the plug as shown. During assembly, the plug is urged into its seat against the thrust of spring 90 with sufficient force to merely assure a good metal-to-metal contact between the plug and the seat. The distance between the top surface 94 of the plug and the plane of

surface 50 on the cover is then measured. One or more spacers or shims 92, which are available to the assembler in various thicknesses, are then selected and mounted on the top surface 94 to fix the distance between the surface 50 and the top surface of the stack of shims within the range of between .004 inches and .008 inches which is considered to be the proper limit of movement of the plug away from its seat in order to provide an optimum sealant/lubricant film thickness between the plug and its seat. Sealant/lubricant is then injected under pressure into the lubricant system through the fitting 40 as described above. The plug will then be moved away from its seat under the influence of spring 90 and under the influence of the pressurized lubricant/sealant until the top of the spacer stack 92 contacts the surface 50.

As explained above, in service, the valve may be exposed to transient conditions of abnormally high pressures, temperatures or vibrations in the line in which the valve is located, all of which would cause the plugs of the prior art valves to project further and further into their seats whereupon dissipation of the transient conditions would cause the valve body to contract which would result in seizure or lockup of the plug. In the valve of the instant invention, however, not only is the plug prevented from following deeper into its tapered seat under transient conditions by the thrust of the spring 90 but, because the plug and spacers 92 are held firmly against the surface 50 of the cover, the proper spacing between the plug and its seat will be maintained when the transient conditions have dissipated.

In another form of the invention, the spacer stack 92 may be dispensed with and the seal ring 44 utilized to achieve the proper spacing between the surface 50 on the cover and the top surface 94 on the plug. In this form of the invention, the seal 44 would function both as a seal and as a spacer and would be available to the assembler in various thicknesses so that during assembly the proper size of the seal/spacer 44 would be selected to hold the distance between the surface 50 and the

surface 94 to the range of .004 inches to .008 inches when the valve plug is in metal-to-metal contact with its seat.

It might be possible to achieve the advantages of the instant invention by simply holding the locations of the surfaces 50 and 94 within very close tolerances during the machining process so that in the assembled relationship, the distance between the surfaces 50 and 94 would be in the requisite range of .004 inches and .008 inches. However, as a practical matter, it is virtually impossible to maintain such close tolerances in practical manufacturing methods particularly when it is realized that relatively small variations in the surface of the tapered seat and the tapered plug will result in relatively large variations in the axial position of the plug.

An important advantage of the instant invention is that the appropriate adjustment for plug travel away from its seat is made during the assembly and cannot be changed in the field without disassembly of the valve. As pointed out above, some prior art valves, such as that shown in the patent to Eshghy, provide a stop member at the large end of the plug against which the plug is urged by a spring. However, since in such valves, the location of the stop may be adjusted by means external to the valve. As a result, individuals responsible for the maintenance of the valve will frequently change the location of the stop in an attempt to cure a valve leak. This, of course, results in a change in the spacing between the plug and its seat often resulting in inadequate lubricant/sealant film, and may also force the plug further into the tapered seat making it even more vulnerable to lockup.

The invention herein described may be embodied in other specific forms without departing from the essential characteristics thereof. The present embodiment, therefore, is to be considered as illustrative, the scope of the invention being indicated by the appended claims. All departures from the foregoing description which come

within the meaning and range of equivalency of the claims are, therefore, intended to be embraced herein.

1. A lubricated plug valve comprised of a body having a tapered seat defining a central chamber within said body, inlet/outlet passages in said body intersecting and communicating with said central chamber, a tapered plug having a port therethrough mounted in said chamber for limited free axial movement away from said seat, means biasing said plug away from said seat, a wall on said body at the large end of said plug having a stop surface for limiting movement of said plug away from said seat, and non-adjustable means for fixing the axial distance said plug may travel away from metal-to-metal contact with said seat under the thrust of said biasing means.

2. The valve defined in claim 1, in which said non-adjustable means is comprised of spacer means of preselected thickness between the large end of said plug and said stop surface.

3. The valve defined in claim 1, in which said non-adjustable means is comprised of spacer means of preselected thickness between said wall and said body.

4. A lubricated plug valve comprised of a body having a tapered seat defining a central chamber within said body, inlet/outlet passages in said body intersecting and communicating with said central chamber, a tapered plug having a port therethrough and mounted for rotation in said chamber between a valve open position and a valve closed position, means biasing said plug away from said seat, a wall on said body at the large end of said plug having a stop surface fixed with respect to said wall for

limiting movement of said plug away from said seat, spacer means of preselected thickness between said stop surface and the large end of said plug for fixing the distance between the stop surface on said wall and the stop surface on said plug when said plug is in metal-to-metal engagement with said seat.

5. A lubricated plug valve comprised of a body having a tapered seat defining a central chamber within said body, inlet/outlet passages in said body intersecting and communicating with said central chamber, a tapered plug having a port therethrough and mounted for rotation in said chamber between a valve open position and a valve closed position, means biasing said plug away from said seat, a stop surface associated with the large end of said plug, a wall on said body at the large end of said plug having a stop surface fixed with respect to said wall for limiting movement of said plug away from said seat, spacer means of preselected thickness between said wall and said body for fixing the distance between the stop surface on said wall and the stop surface on said plug when said plug is in metal-to-metal engagement with said seat.

6. A lubricated plug valve comprised of a body having a tapered seat defining a central chamber within said body, inlet/outlet passages in said body intersecting and communicating with said central chamber, a tapered plug having a port therethrough and mounted for rotation in said chamber between a valve open position and a valve closed position, means biasing said plug away from said seat, a stop surface associated with the large end of said plug, a wall on said body at the large end of said plug having a stop surface limiting movement of said plug away from said seat, and non-adjustable means between said wall and said plug for fixing the axial distance said plug may travel away from metal-to-metal contact with said seat.

7. A lubricated plug valve comprised of a body having a tapered seat defining a central chamber within said body, inlet/outlet passages in said body intersecting and communicating with said central chamber, a tapered plug having a port therethrough mounted for rotation in said chamber between a valve open position and a valve closed position, means biasing said plug away from said seat, a stop surface associated with the large end of said plug, a wall on said body at the large end of said plug having a stop surface for limiting movement of said plug away from said seat, and non-adjustable means between said wall and said plug for fixing the distance between the stop surface on said wall and the stop surface on said plug when said plug is in metal-to-metal engagement with said seat.

8. A lubricated plug valve comprised of a body having a tapered seat defining a central chamber within said body, inlet/outlet passages in said body intersecting and communicating with said central chamber, a tapered plug having a port therethrough mounted for rotation in said chamber between a valve open position and a valve closed position and for limiting axial movement away from said seat, a first stop means associated with the large end of said plug, a wall on said body at the large end of said plug having second stop means adapted to be contacted by said first stop means, and means inaccessible from the exterior of said valve for fixing the distance between said first and second stop means to a predetermined amount when said plug is in metal-to-metal engagement with said seat, and resilient means urging said plug away from its seat to maintain said first and second stop means in engagement.

9. The valve defined in claim 8 in which said means for fixing the distance between said first and second stop means is spacer means of preselected thickness between said wall and said body.

10. The valve defined in claim 8 in which said first stop means is comprised of one or more spacers of preselected thickness between the large end of said plug and said second stop means.

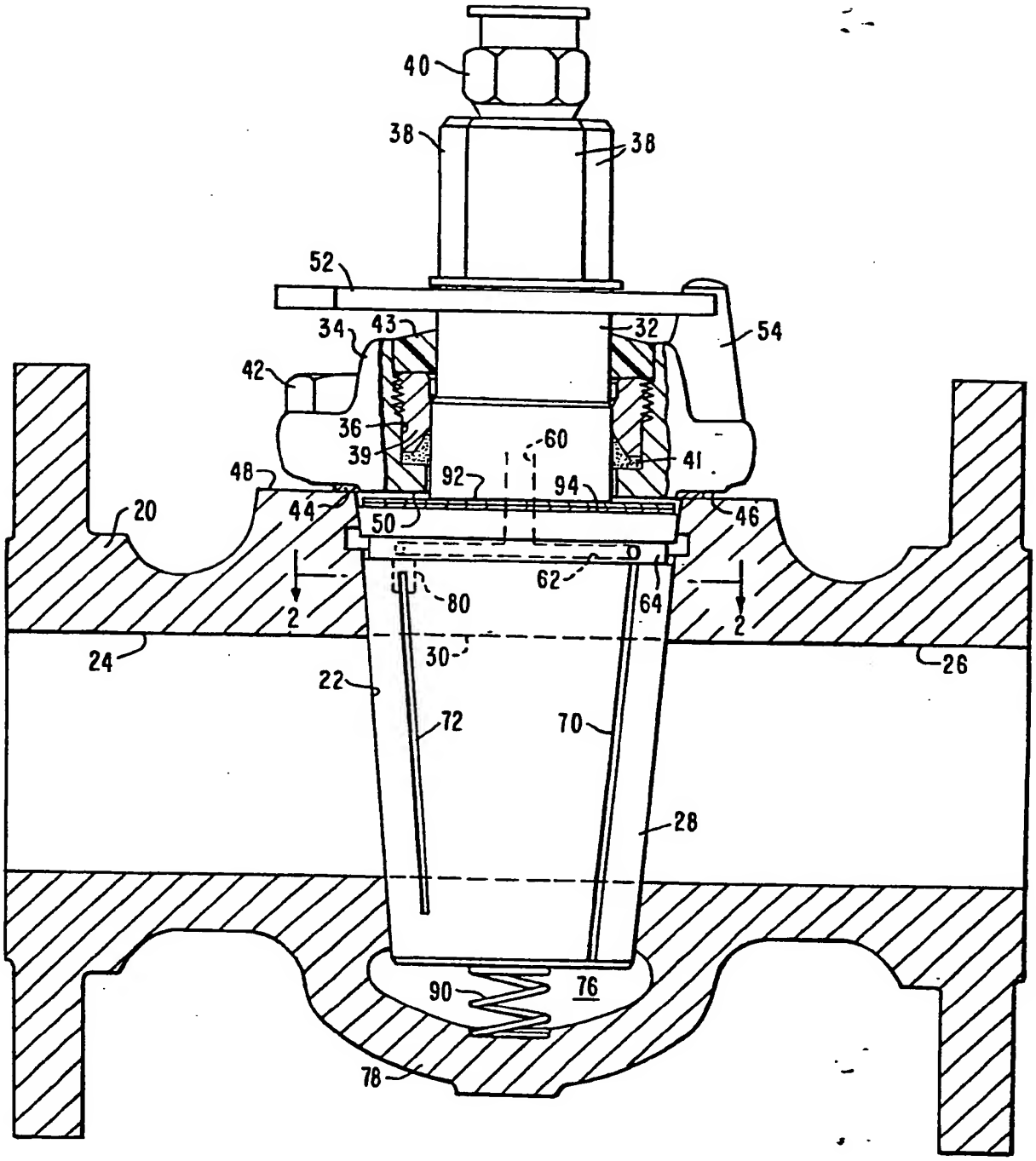

FIG. 1

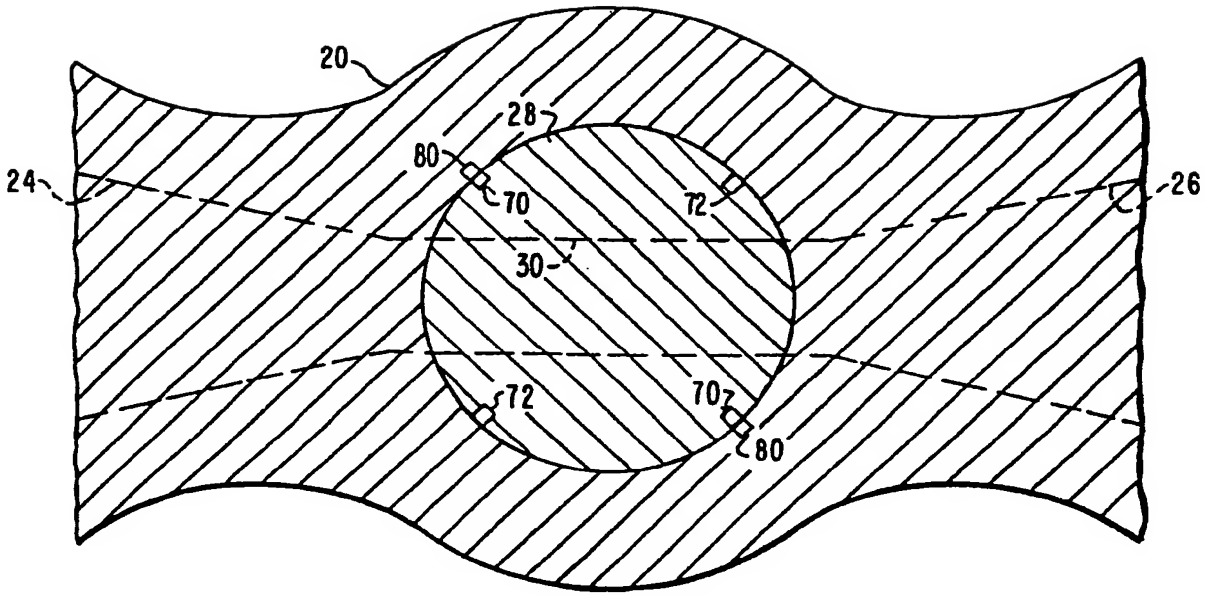

FIG.2

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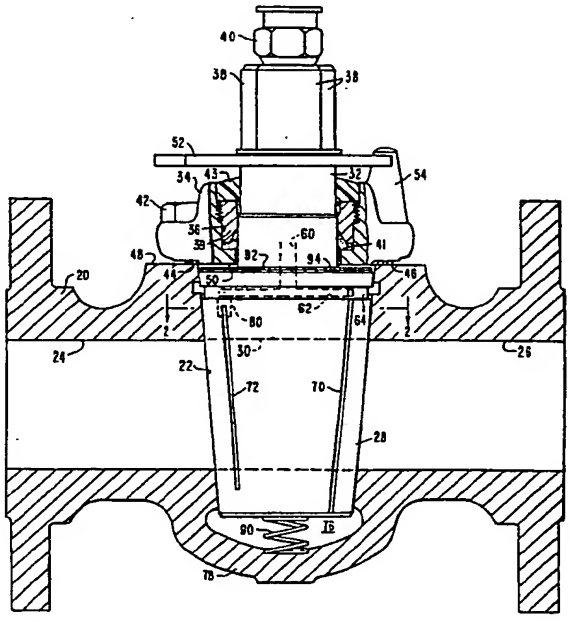
(54) Plug valve with fixed seating adjustment.

(57) A lubricated tapered plug valve has a plug (28) mounted for limited free axial movement away from its seat (22). The cover (34) on the body (20) at the large end of the plug (28) has a stop surface (94) for limiting movement of the plug (28) away from the seat (22) and spacers (92) of preselected thickness are provided for fixing the axial distance the plug (28) may travel away from metal-to-metal contact with the seat (29) under the thrust of a spring (90) which urges the plug (28) away from its seat (22).



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EUROPEAN SEARCH REPORT

0100987
Application number

EP 83 10 7559

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl. ³)
A	FR-A-2 402 131 (ROCKWELL INTERNATIONAL CORP.) * Page 3, lines 2-12; page 7, line 26 - page 8, line 26; figures *	1	F 16 K 5/22
A	US-A-2 829 667 (MUELLER) * Column 3, lines 31-34; figures 1,2 *	1	
A	FR-A-1 157 856 (ROCKWELL MANUFACTURING CY.) * Page 6, left-hand column, paragraph 2; page 7, right-hand column, last but one paragraph; figures *	1	
A	FR-A-1 280 112 (PEROLO) * Page 1, right-hand column, last but one paragraph; figure 1 *	1	TECHNICAL FIELDS SEARCHED (Int. Cl. ³) F 16 K
D,A	US-A-2 945 668 (STALLER) * Column 6, lines 26-32; figure 1 *	1	

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	18-11-1983	VAN REETH A.L.J.

CATEGORY OF CITED DOCUMENTS

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